

NPP All Hands (Minds) Meeting

9 July 2015

Berndt Mueller

Associate Laboratory Director
for Nuclear & Particle Physics



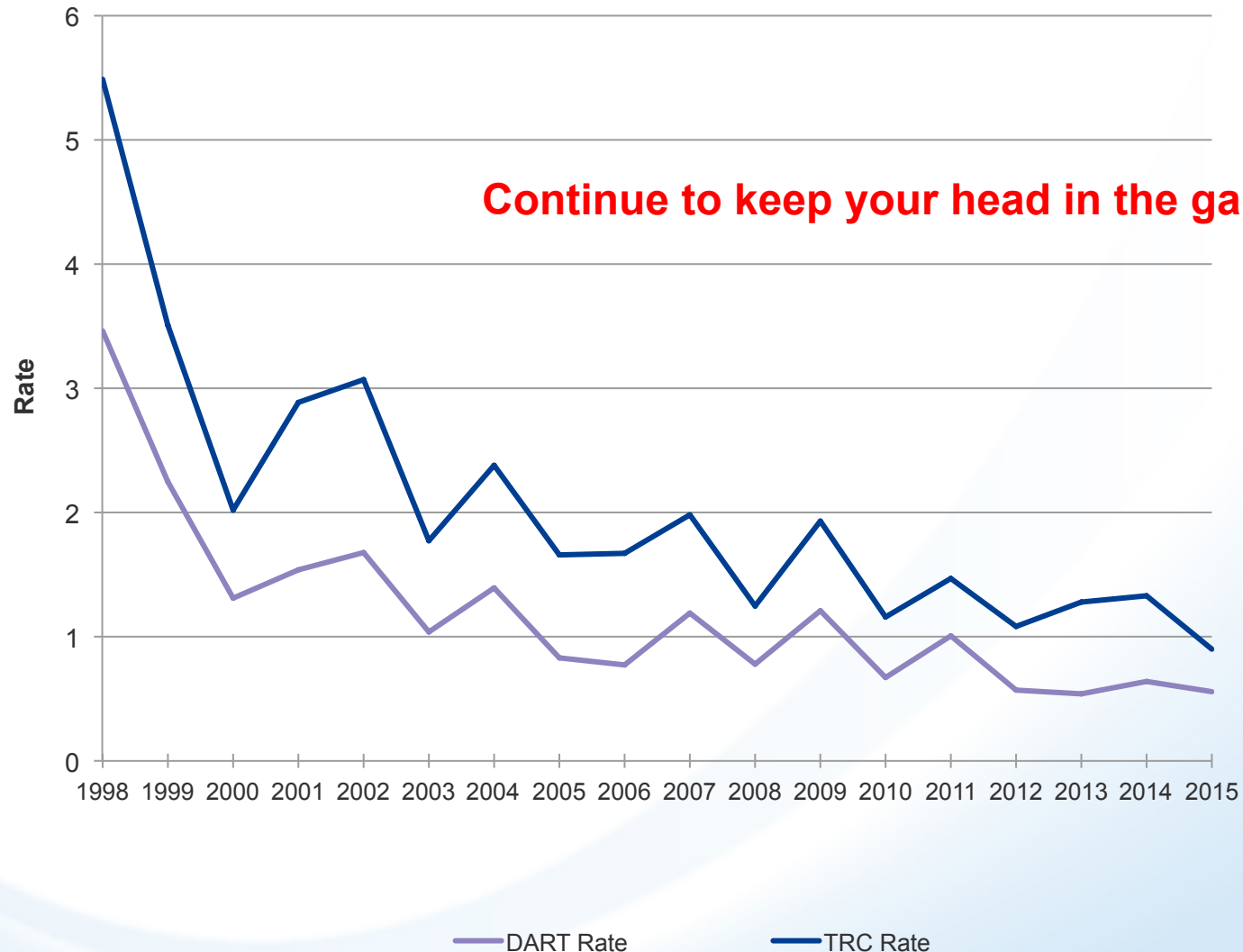
Today's topics

- Safety
- 2015-24 Lab Plan Feedback
- NP Long Range Planning
- Budget Challenges

There are significant budget challenges for the balance of this fiscal year and possibly into next year. I will elaborate more on this later. For now, I want to stress that it is our intent to manage the situation such that necessary staff reductions are realized by attrition to the extent possible.

Your active participation in reducing cost for the balance of this year will in part determine how successful we are in that strategy.

Injuries continue to decline



Brookhaven National Laboratory FY15 – FY24 Plan

Doon Gibbs

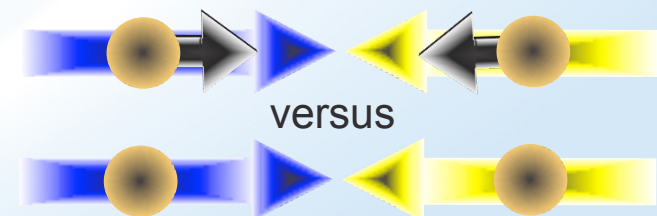
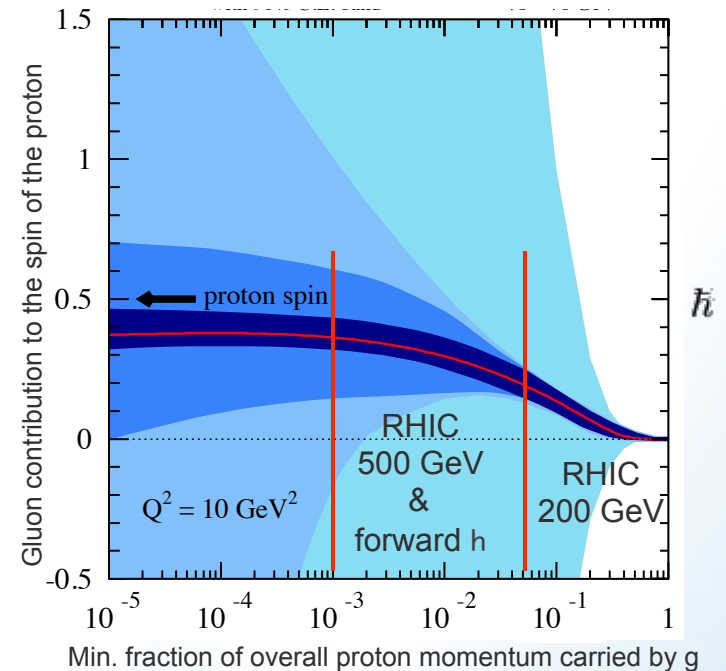
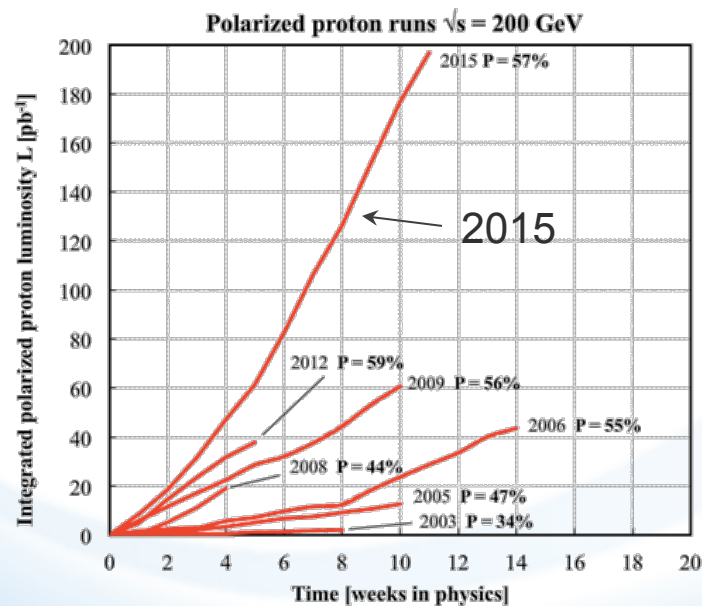
Presentation by LD Doon Gibbs at DOE Headquarters on 25 June 2015

Attended by LD, DDO, DDST, 3 Science ALDs
SC Director (Dehmer) and all Associate Directors

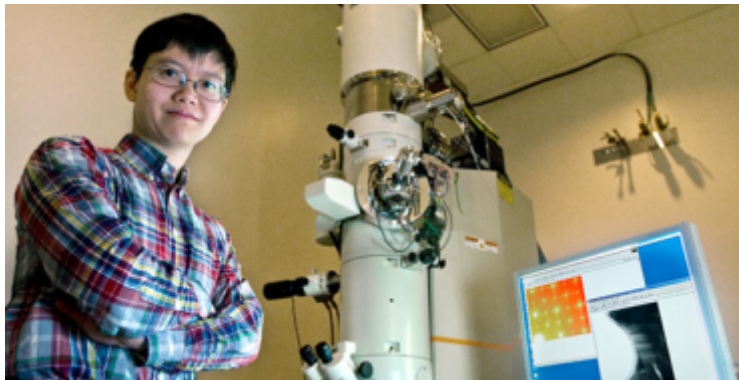


Record Luminosity and First Signs of Gluon Polarization at RHIC

- Record luminosity of 100+100 GeV polarized proton-proton collisions
- Run-15 integrated proton luminosity at $\sqrt{s} = 200$ GeV exceeds that of all previous runs combined at this energy
- First evidence that the strong force (gluons) is responsible for 40% or more of the proton's spin



BNL Scientists Received Prestigious DOE Awards



Jing Tao
BES, Early Career Recipient

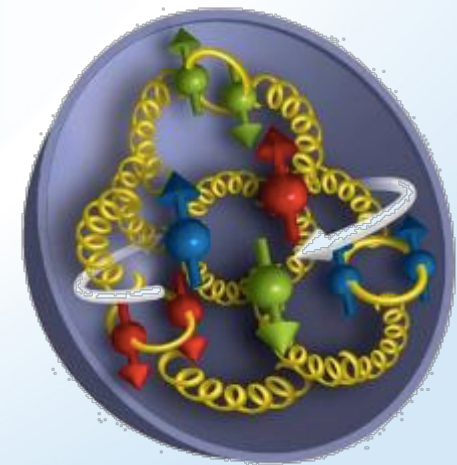
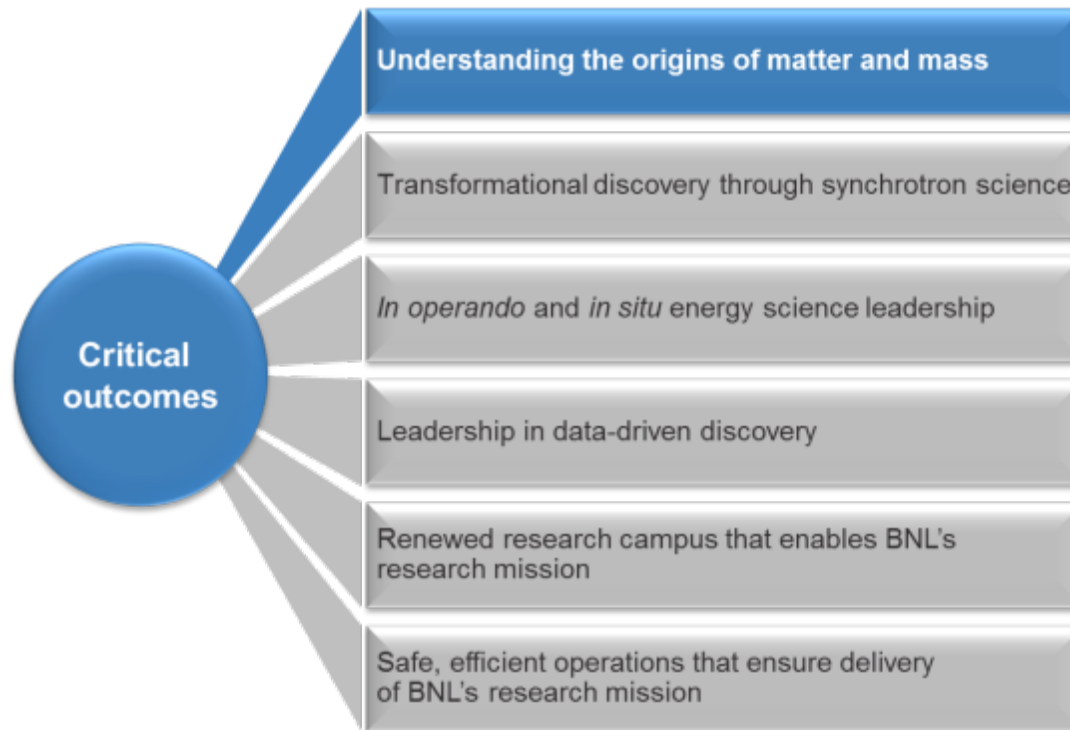


Members of the Superconducting
Magnet Division
*The Secretary's Honor Award for
Achievement (two LHC magnets)*



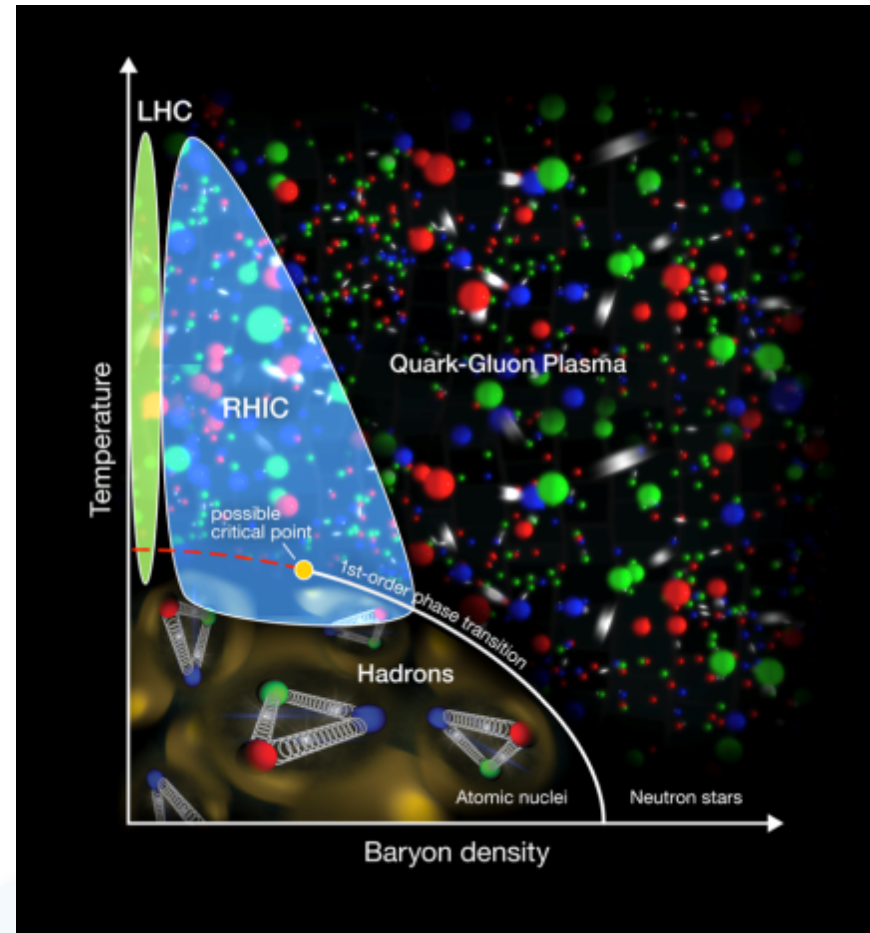
Mei Bai
Ernest Orlando Lawrence Award

Understanding the Origins of Matter and Mass



RHIC is the Perfect Facility to Explore the Phases of Nuclear Matter

- QCD matter turns from a nucleon superfluid into a nucleon/hadron gas at approximately 100 billion degrees
- When heated to 2 trillion degrees at RHIC, nuclear matter suddenly turns into a liquid again
 - The most perfect liquid ever observed
- **Only RHIC has the energy range to observe where the transition occurs**



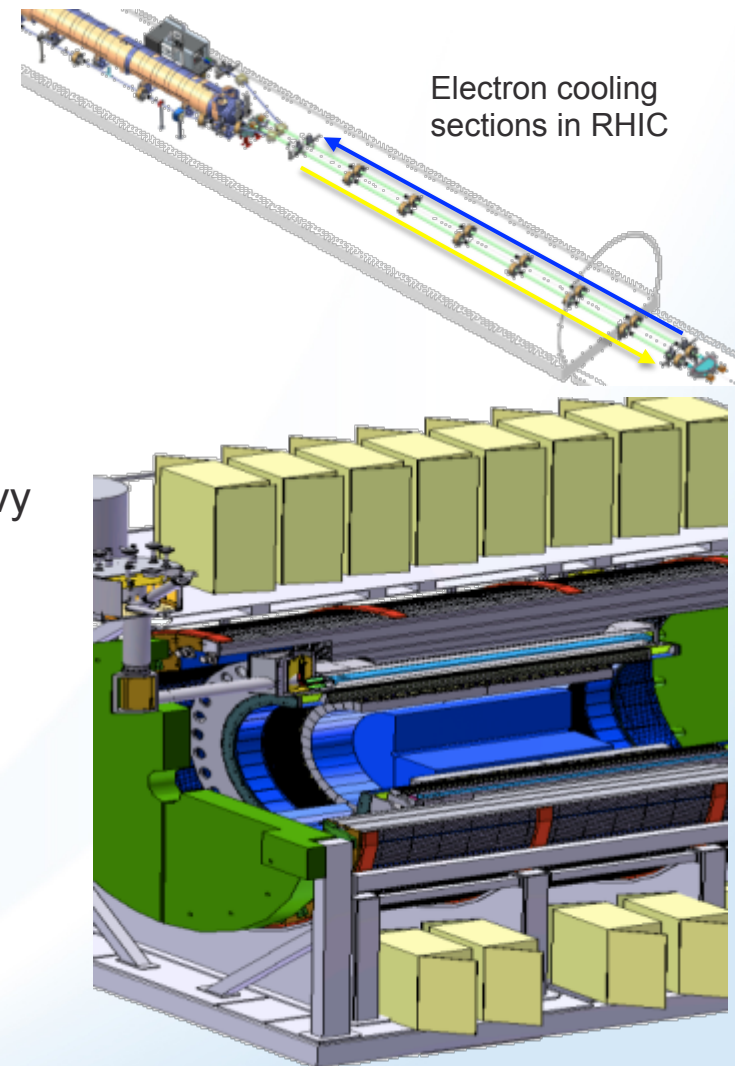
Completing the RHIC Mission

Status:

- RHIC-II configuration is now complete
 - 3D stochastic cooling
 - Vertex detectors in STAR (HFT) and PHENIX
- RHIC Run 15 – first proton-gold collisions

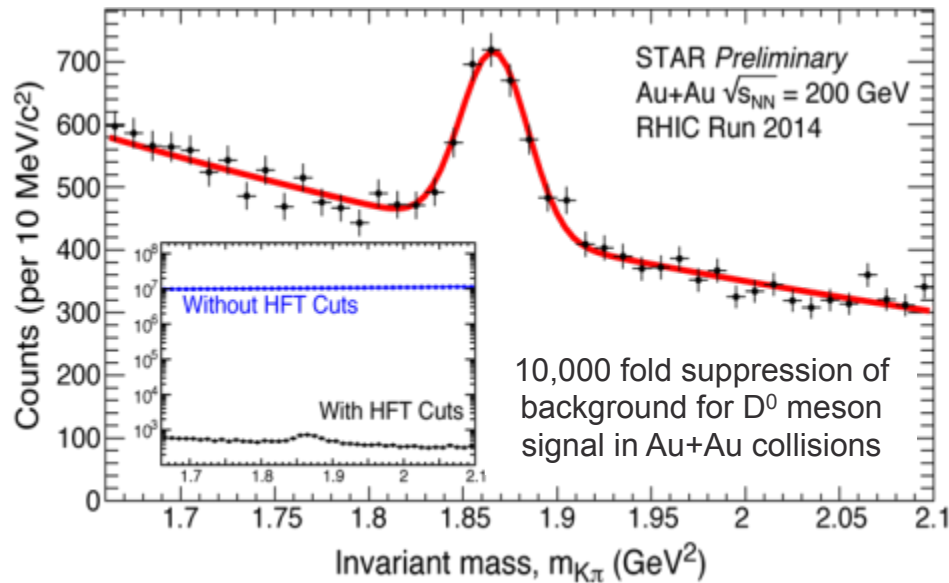
Plan: Complete the RHIC Mission in 3 campaigns:

- **2014 - 17:** Understand the properties of the strongly correlated quark gluon plasma using heavy quark spectroscopy
- 2018: Install low energy e-cooling
- **2019/20:** High precision scan of the QCD phase diagram
- 2020: Install sPHENIX upgrade
- **2021/22:** What makes the QGP a perfect fluid: Elucidate the fluid correlations using jets
- 2023/2024: RHIC shutdown and transition to eRHIC (assuming NSAC/DOE/Congressional alignment)



RHIC remains a unique discovery facility:
~3,000 citations/year, ~30 PhDs per year

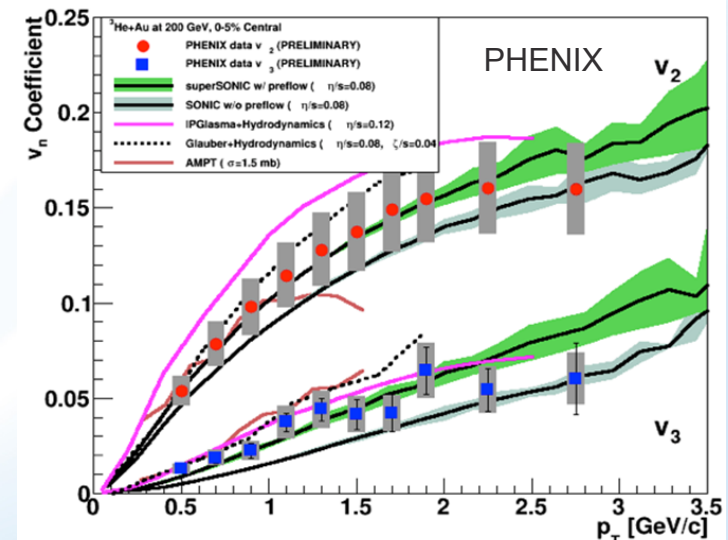
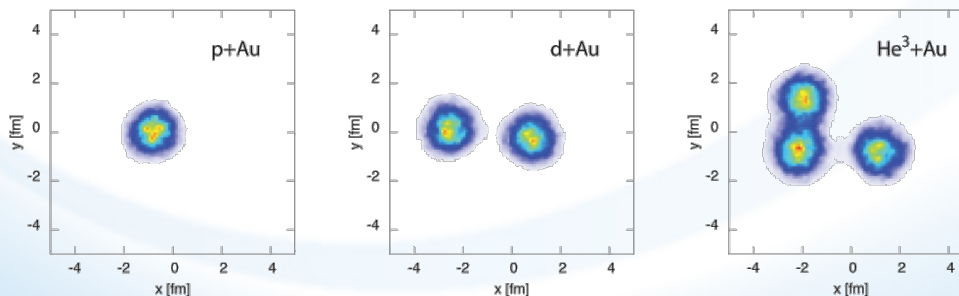
Hydrodynamics of the Perfect Fluid



Heavy Flavor Tracker (HFT) in STAR to measure heavy quark flow

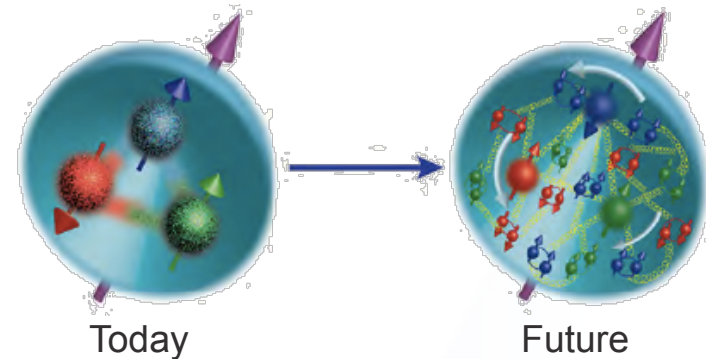
How small can a drop of QGP be?

Exploiting RHIC's species versatility for exquisite control of initial geometry – now have excellent p +Au, d +Au and ^3He +Au data sets

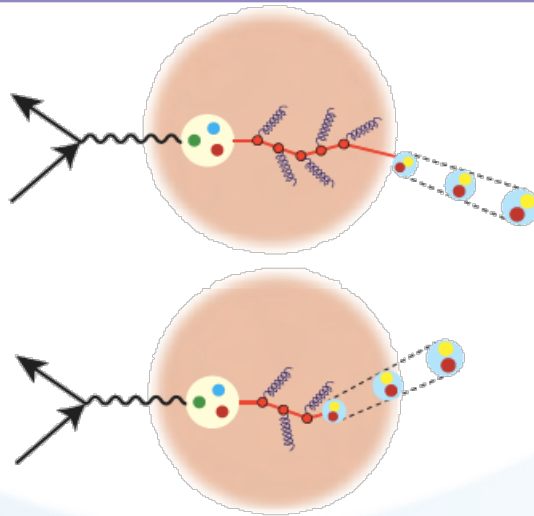


EIC: QCD Laboratory of the Future

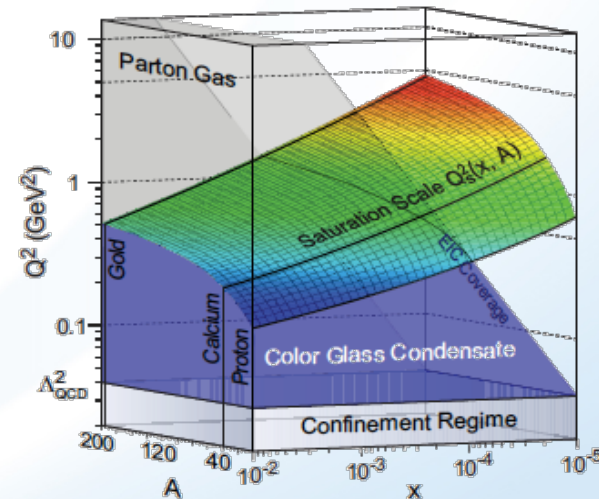
Gluon structure of the “cold” proton:
How is the proton’s mass
generated and what carries its spin?



How do confined hadrons emerge
from isolated quarks? (“ARPES”)

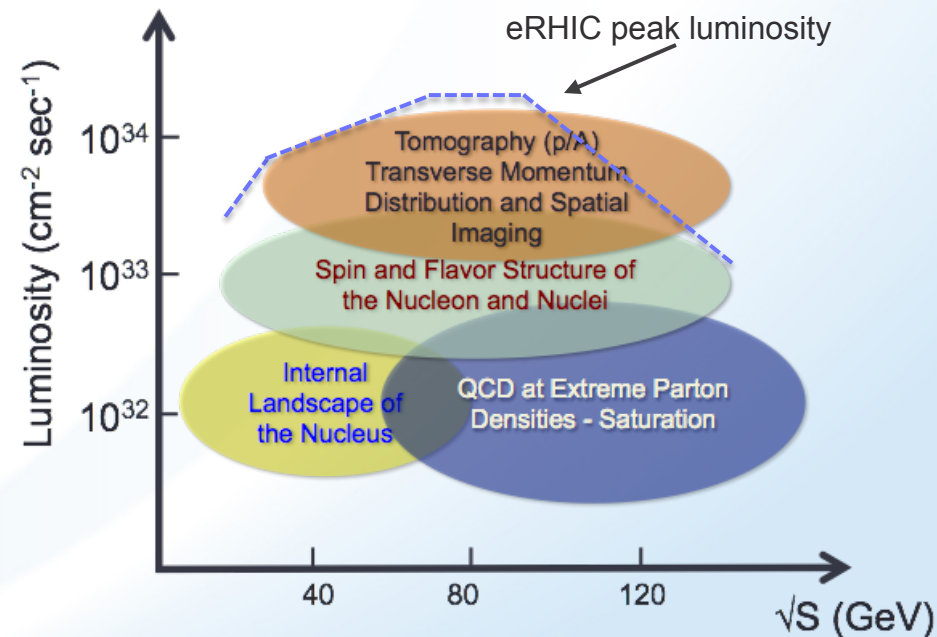
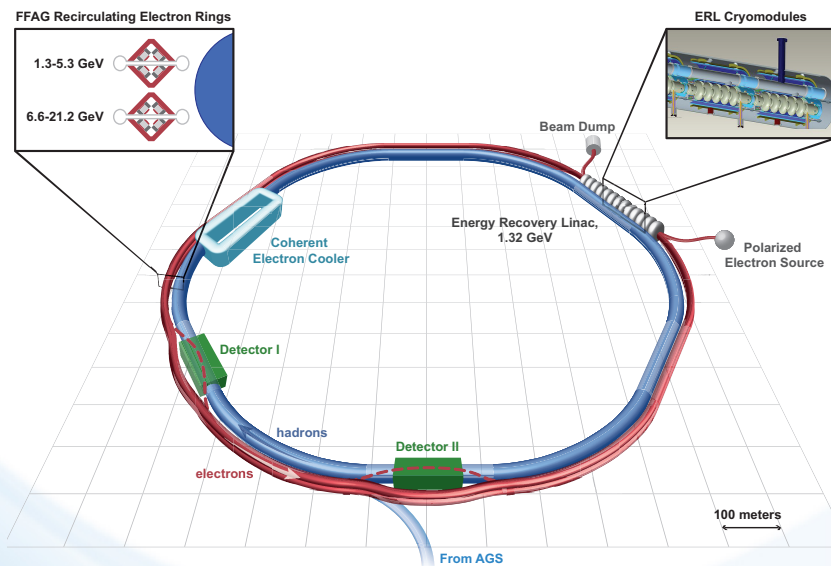


High density phase of
low energy gluon matter



eRHIC Design: Innovative and Cost-Effective

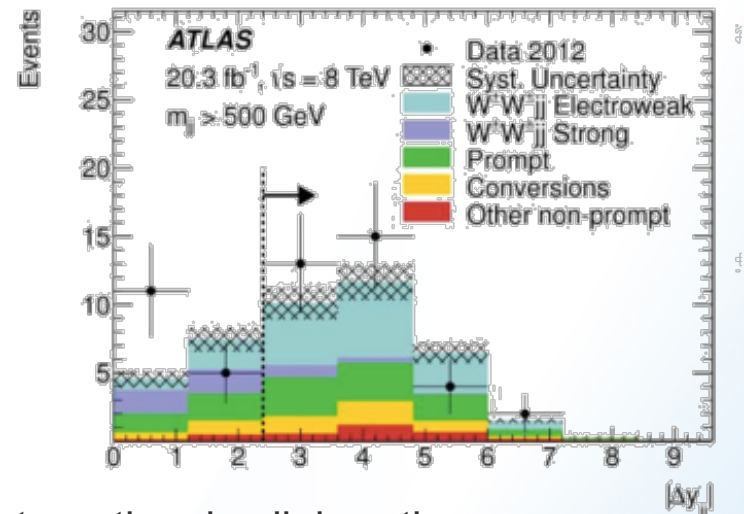
- World's first Linac-ring collider—re-cycles RHIC
- Energy Recovery Linac (ERL) reduces power consumption from 1 GW to 20 MW
- Coherent electron cooling for record high beam brightness
- Bent strongly focusing recirculating arcs propagate beams with multiple energies
- eRHIC luminosity and energy reach covers the full science of the EIC proposal
- Issues:
 - R&D to address/mitigate technical design risks underway
 - Tight budgets



When complete, eRHIC will be the most advanced and energy efficient accelerator in the world

Accelerating the HEP Mission

- **Energy Frontier**
 - ATLAS ready for data taking at LHC full energy
 - ATLAS Phase I upgrade received CD-2
 - Preparation for Phase II upgrade is well advanced
 - Led important analysis on Vector Boson Scattering
- **Intensity Frontier**
 - Key role in reorganizing/forming the LBNF/DUNE international collaboration
 - Important BNL contributions to FNAL's approved Short Baseline Neutrino Program
 - Daya Bay continues to produce new results, such as first evidence for neutrino oscillation from reactor neutrinos
- **Cosmic Frontier**
 - Important contributions to CD-2/3 approval for LSST camera
- **Accelerator R&D**
 - ATF achieves national SC user facility status
- **Challenge/Issue**
 - We are engaged in constructive dialogue with OHEP on prioritization of our activities



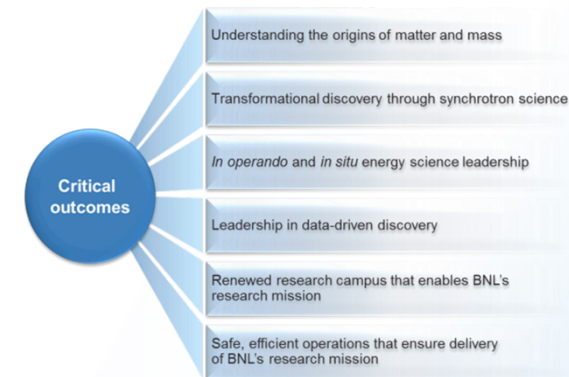
It Has Been an Amazing Year

We have made enormous progress

- Improving safety record; evolving culture of accountability
- NSLS-II performance/commissioning
- Record RHIC operations; world-leading science
- Strong start of energy storage EFRC and integration with NSLS-II, with NSLS-II and CFN
- High impact *in operando* science publications
- Strong, developing relationship with NYS
- Significant progress on Discovery Park
- Renewed vision and new management contract

There remain significant challenges

- Build out NSLS-II beamlines; develop world-class, integrated science program
- Complete RHIC mission; transition to eRHIC
- Grow big data
- Address BER vision issues
- Sustain operational excellence/safety
 - Strengthen the business environment
 - Address infrastructure issues
 - Achieve sustained growth/savings



2015-24 Lab Plan Feedback

General Comments:

We note that slide 39 [the *Amazing Year* slide] is an excellent summary of recent accomplishments and challenges, and it is useful as our summary of general comments. In many cases, it would be useful for the lab to engage in hard-nosed competitor/collaborator analyses.

- RHIC: **Stunning accomplishments** and an incredible near-term science program. Transitioning to an EIC will not be easy, if it is possible.
- SLI: Excellent new SLI (Science Laboratory Infrastructure) plan including B725 & B911 renovations, Discovery Park.
- The new BSA: Great new BSA!

Program specific comments (HEP)

HEP: Some peripheral lab research efforts that were not well-aligned with P5, or did not review well in past comparative reviews, have been phased out. We applaud lab management's attention to these issues; we believe the remaining activities are well aligned with P5 recommendations.

HEP: The overall Cosmic Frontier efforts are well-aligned with P5, with people from the Instrumentation Division (funded by the Lab and Project funds) having significant responsibilities on the LSST camera MIE Project, and the HEP-funded Cosmic Frontier research group concentrating on science analyses and operations activities on the currently operating experiments along with LSST.

HEP: In accelerator science and technology, BNL's breadth of accelerator activities positions it well positioned to participate more broadly in the Accelerator Stewardship program. For example, NSRL's unique capabilities could support NIH/NCI's need for radiobiology studies in support of ion beam therapy. The latter could be addressed by engaging with the Accelerator Stewardship program.

HEP: Institutional support for ATF-II and the instrumentation group is greatly appreciated by HEP.

Program specific comments (NP-1)

NP: RHIC is highly commended for its world-leading research to discover the properties of the Perfect Quark-Gluon liquid; to understand the origin of the proton spin with emphasis on determining the contribution from gluons; to search for a critical point in the QCD phase diagram; to identify and produce new and better isotopes as well as better isotope production/processing techniques; to develop groundbreaking intellectual connections and broader impacts of discoveries made at RHIC.

NP: BNL is commended for its intellectual leadership in the development of the 2015 Long Range Plan for Nuclear Science and, along with scientific and technical staff from TJNAF, for further development the scientific justification and technical feasibility of a possible future electron-ion collider.

NP: RHIC is highly commended for continuing to excel in advancing the efficiency and luminosity of RHIC beams, including implementation of "first-ever" new configurations that significantly extend the scientific reach of the RHIC program.

Program specific comments (NP-2)

NP: Continued close coordination with NP will be essential to determine, near term, next steps towards the implementation of upgrades to carry out remaining elements of RHIC's science mission including a detector capable of high rate jet measurements to determine the structure and dynamics of the perfect liquid at length scales relevant for understanding the physics underlying emergent phenomena such as jet quenching and suppression of heavy flavor.

NP: BNL is commended for taking steps to ensure continued effective operation of the BLIP facility to produce isotopes for national needs.

SUMMARY: We have great accomplishments on all sides (machine, experiments, theory) and truly exciting opportunities, but we also face significant challenges: technical (e.g. LEReC), structural (PHENIX ending), schedule (sPHENIX, LEReC), budget (sPHENIX), risk/cost (eRHIC).

We need to be determined, smart, wise, and willing to make hard choices.

NP Long Range Plan

Very successful LRP Resolution Meeting in April in Kitty Hawk with very strong BNL participation (T Roser, R Venugopalan, BM) and strong local supporters (A Deshpande, K Rajagopal, W. Zajc,....)

Strong scientific cases for RHIC and EIC.

Recommendations are not yet public, but will include completion of the RHIC science mission, EIC facility, EIC R&D.

Update at July 16 NSAC meeting; presentation to NSAC probably in early September (?). Due at DOE in October.

Transition from RHIC to EIC (eRHIC?) is main budgetary challenge.

U.S. HEP Priorities

The U.S. program in HEP is being defined following the P5 report.

Two new major projects are being planned:

- **High Luminosity Upgrades to the LHC:**
 - Including Accelerator, and experiments (ATLAS and CMS)
- **LBNF/DUNE (formally LBNE):**
 - including a Near Detector, 40 Kton LAr TPC underground and a major upgrade to the FNAL accelerator (PIP-II) .

In addition to international contributions to LBNF/DUNE the cost of the U.S. part of these programs is \$2B+. This is expected to be paid using a “bump” in the HEP budget and a significant redirection from the research program.

DOE recently asked ALL National Labs to:

- ☐ **Submit a 7-year plan with a flat-flat budget for the first few years followed by small (below inflation) increases in the last years.**
- ☐ **Prioritize their research activities.**
- ☐ **Phase out low priority and sub-critical parts of the program.**

BNL HEP Priorities

BNL has submitted its plan with the following priorities in the research:

1. **The Energy Frontier (EF)**, focusing on our role as host Laboratory for **U.S. ATLAS**, which includes optimizing contributions to the research program, the operations program, the Phase I upgrade, and preparations for Phase II;
2. **Neutrino physics at the Intensity Frontier (IF)**, which includes a prominent role in the DUNE experiment and the SB neutrino efforts, with key contributions to cold electronics, TPC design, and project management of the far detector;
3. A modest but highly focused effort in **dark energy research at the Cosmic Frontier (CF)**, which leverages our intimate knowledge of the LSST detector (from design and construction of the science rafts) to optimize LSST physics reach (gravitational lensing, etc); and
4. A notable, but limited, participation in the muon-based IF in the g-2 and mu2e experiments at Fermilab.

The plan was well received at OHEP and we believe that it would allow BNL to maintain its leadership role in ATLAS and in the neutrino program as well as secure a modest but viable cosmic frontier program at LSST.

NP Budget Challenge

Current spending in NP (C-AD and Physics) exceeds FY15 new funds.

Many reasons: Flat FY15 RHIC Ops budget, >6% SLR increase in 2015, unsustainable staffing levels in Physics, etc.

Draw-down of carry-over funds will put the RHIC program at risk, if there is a continuing budget resolution in October 2015. Year-end return of over-collected salary/fringe will help, but we need to reduce expenses for the rest of the budget year as much as possible. We all can help:

- Take your vacation before October (Supervisors will work with you).
- Vacation carry-over requests will not be “routinely” approved !!!
- Minimize over-time.
- Accurately record time worked on non-RHIC related efforts or medical time off (doctor’s visits, sick time, etc.).
- Spend allocated LDRD or PD funds before the end of the budget year.

Moderate reduction of workforce in Physics unavoidable. We will work hard on finding solutions for everyone, but cannot guarantee them.

Summary

- 2015-24 Lab Plan very well received by DOE
- NP (and HEP) on track for outstanding grade
- NP LRP promises excellent set of recommendations
- Make sure to take your vacation this year
- Let's make this the safest year ever
 - Keep your head in the game
 - Beware of slips, trips, falls, and other lapses of attention

Let's celebrate

25 years: S. Badea, R. Meier, P. O'Connor, R. Soja, M. Zarcone

30 years: SY. Zhang, T. Tallerico, L. Di Filippo, D. Beavis, R. Katz, J. White Jr, L. Vogt, T. Blydenburgh, [D. Lissauer](#), T. Rao, W. Guryn, L. Feierabend

35 years: A. Hershvovitch, J. Mills, P. Manning, J. Curley, J. Tuozzolo, W.T. Weng

40 years: A. Etkin, [P. Wanderer](#), E. Mogavero

45 years: [H. Gordon](#)

50 years: C. Carlson

Refreshments and cake are in the Lobby!